Abstract of a Meteorological Journal kept at Benares during the Years 1824, 1825, *and* 1826. *By* James Prinsep, *Esq. Assay Master of the Mint at Benares. Communicated by* Peter Mark Roget, *M.D. Secretary of the Royal Society.* Read January 25, 1828. [*Phil. Trans.* 1828, *p.* 251.]

The registers, of which the monthly results are presented in a tabular form, contain an account of the states of the barometer, thermometer, the air hygrometer, the wet bulb hygrometer, the degrees of aqueous tension, amount of evaporation, quantity of rain, wind, and other circumstances relating to the weather at Benares during three successive years. The author states it as his opinion, that the diurnal oscillations of the barometer, as well as the monthly variations, are dependent on the alterations of the specific gravity of the air from changes in its temperature; the operations of which may be traced with much greater distinctness at Benares than in the more variable climates of Europe. He illustrates his position by graphic representations of the changes in the barometer, corresponding with those of the thermometer.

He next points out a method of reducing the indications derived from hygrometers of different constructions, to absolute degrees of aqueous tension: and concludes, by expressing a hope that the cultivators of hygrometrical science in Europe would take pains to furnish standard instruments of comparison at the several principal stations on the Indian continent; as such a measure is the only security which can be obtained against inaccuracy in the observations that are now very extensively carried on in that part of the world.

A Description of a vertical floating Collimator; and an Account of its application to Astronomical Observations with a Circle and with a zenith Telescope. By Captain Henry Kater, *V.P.R.S.* Read April 24, and May 1, 1828. [*Phil. Trans.* 1828, *p.* 257.]

The construction of the instrument which forms the subject of this paper, is a material improvement on that of the horizontal floating collimator, of which an account was given by the author in the Philosophical Transactions for 1825. Its superiority is derived from its adaptation to the vertical instead of the horizontal position, by which the sources of error arising from the necessity of transferring the instrument to different sides of the observatory, and of taking the float out of the mercury and replacing it, at each observation, are wholly obviated. The vertical floating collimator has the further advantage of being adapted for use, not only with a circle, but also with a telescope, either of the refracting or reflecting kind. Such a telescope, furnished with a wire micrometer, and directed to the zenith, becomes a zenith telescope, free from all the objections to which the zenith sector, and the zenith telescope, with a plumb line, are liable.

The instrument itself is supported on a square mahogany stand, which slides on two parallel beams fixed at the upper part of the ob-

servatory in the direction of the meridian, and which has a circular aperture in the centre, having at its edge a projecting rim of iron to admit of the passage of the telescope. The telescope, of which the focal length is 8 inches, is supported in the vertical position by a bridge connecting it with a circular iron ring, 10 inches and $\frac{6}{10}$ths in diameter, which floats in mercury. The mercury is contained in a circular iron trough, the central aperture of which is sufficiently large to allow of its turning freely round the rim, which rises from the margin of the aperture of the stand. The object-glass of the telescope is placed at its lowest end, and its focus is occupied by a diaphragm, composed of two brass plates, each cut so as to form an angle of 135°, and placed opposite to each other, so that the angular points are brought to an accurate coincidence; thus leaving on each side intervening spaces, which form vertical angles of 45° each. The telescope below, whether belonging to a circle or a zenith telescope, is to be directed so that the image of these angles shall be bisected by the micrometer wire; for which purpose the diaphragm of the collimator is illuminated by a bull's-eye lantern, placed at a convenient distance upon one of the beams crossing the observatory, the light being reflected downwards by a plane mirror placed on a screen with a suitable aperture immediately above the collimator. The collimator is then to be turned half round in azimuth, the motion being facilitated by rollers, and limited, as to extent, by two catches which receive a projecting wire fixed to the outer circle of the trough. When in this situation, the observation of the diaphragm by the telescope, and the bisection of its angles, are to be repeated, and the mean of the two positions will indicate the exact point of the zenith.

Minute directions are given by the author for the construction of all the parts of the collimator, and for their proper adjustments; together with an account of the precautions to be taken in the employment of the instrument. The time required for completing the determination of the zenith point by its means, need not exceed two minutes; and if to this be added the time necessary for a second set of observations of the same kind, for the purpose of verification, and of a nearer approach to accuracy, the whole time required will not be more than five minutes, during which it is not probable that any sensible disturbance can have taken place in the position of the instrument from changes of temperature.

Tables are given containing registers of numerous series of experiments, made both by the author and by several of his friends, with a view to determine the stability of the instrument and the degree of reliance that can be placed in the results. In the first series, out of 60 independent determinations of the zenith point, there are 25, the error of each of which does not exceed $\frac{1}{10}$th of a second; 37 under $\frac{2}{10}$ths; 47 under $\frac{3}{10}$ths; 55 under $\frac{4}{10}$ths; 3 between 4- and 5-tenths; and 2 a little above half a second. But the author thinks it probable that the greater part of these errors, minute as they are, must be attributed to want of power in the micrometer; which power is directly as the focal length of the object-glass or mirror of the telescope to

which it is attached, and which necessarily limits the precision of which it is capable.

The author next gives the results of some experiments with a collimator made for Captain Foster, having a float of only 5 inches in diameter, and with a telescope 5 inches long; the errors generally do not amount to more than $\frac{2}{10}$ths of a second.

He then enters into details as to the manner of using the vertical floating collimator in astronomical observations, beginning with the portable azimuth and altitude circle, described by the Rev. F. Wollaston in his *Fasciculus Astronomicus*, and applicable to other similar instruments. The new collimator affords also the most perfect method of adjusting the line of collimation of a mural circle or of placing it at right angles to the axis.

The author next proceeds to describe the method of applying the instrument to the zenith telescope. In comparing the observations made by the zenith sector, belonging to the Board of Ordnance, with the zenith telescope used in conjunction with the vertical floating collimator, the mean of errors in the former case was $+0''{\cdot}54$ and $-0''{\cdot}75$; in the latter $+0''{\cdot}44$ and $-0''{\cdot}66$. From observations made on γ Draconis, the zenith distance of which at Greenwich is $0°\ 2'\ 6''{\cdot}36$, and at York Gate $0°\ 0'\ 35''{\cdot}67$; the difference of latitude between the two places was found to be $0°\ 2'\ 42''{\cdot}03$; that of Greenwich being $51°\ 28'\ 38''{\cdot}96$, and of York Gate $51°\ 31'\ 20''{\cdot}99$. The decimals of a second, by the azimuth and altitude circle and the horizontal floating collimator, were ·94; by the same instrument and the vertical floating collimator, ·76; and by the zenith telescope, and the vertical floating collimator, ·92: the mean being ·9.

From the greater degree of precision attainable by the employment of the vertical floating collimator, from the facility of its construction, the readiness of its application, and the time saved by using it, the author deems it not unreasonable to infer, that ere long, the use of the level and plumb-line in celestial observations will be wholly abandoned.

On the Height of the Aurora Borealis above the surface of the Earth; particularly one seen on the 29th of March, 1826. *By* John Dalton, *F.R.S.* Read April 17, 1828. [*Phil. Trans.* 1828, *p.* 291.]

The author observes that opinions differ as to the elevation of the Aurora Borealis above the surface of the earth, and that this is a point which can be determined only by a series of concurring observations. The appearance of a phenomenon of this kind on the 29th of March, 1826, assuming the form of a regular arch at right angles to the magnetic meridian, and marked by peculiar features, continuing for above an hour in the same position, afforded a most favourable opportunity for obtaining the data requisite for the solution of this problem; and the author accordingly took great pains to collect as many authentic accounts as possible of the apparent position of this luminous arch with reference to the stars, when seen